

## TECHNICAL FIELD

The present invention relates to heads for gasoline internal combustion engines in general and more specifically to head conversions having four valves per cylinder with the spark plug centered between the valves and push rods communicating directly with rocker arms actuating the valves.

## BACKGROUND ART

Previously, attempts have been made in engine modifications replacing the head with a retrofit that utilizes the existing camshaft driving pushrods, rocker arms and four valves, which are arranged in the classic "V" form of the intake and exhaust valves. In the past, for motorcycle engines having two cylinders set at a "V" have typically used, for this conversion, rockers arms having two fingers actuating each valve. This necessitates the periodic adjustment for the proper operating clearance of the space between each valve and rocker arm finger. Diesel engines with four valves per cylinder, commonly use a rocker arm having a single finger, which actuates a yoke or beam straddling both valves, with balanced action between them enabling the use of a single valve operating clearance adjustment between the pushrod and the rocker arm. Since this invention duplicates this concept, the standard rocker arms, pushrods and hydraulic tappets can be utilized.

A search of the prior art did not disclose any patents that read directly on the claims of the instant invention, however, the following U.S. patents were considered related:

| PAT. NO.  | INVENTOR        | ISSUED           |
|-----------|-----------------|------------------|
| 4,819,591 | Valentine       | April 17, 1989   |
| 4,023,543 | Ishikawa        | May 17, 1977     |
| 3,884,199 | Irimajiri et al | May 20, 1975     |
| 2,884,913 | Heintz          | May 5, 1959      |
| 2,863,429 | Bouteleux       | December 9, 1958 |
| 2,700,966 | Hofer           | February 1, 1955 |
| 5,007,387 | Arao            | April 16, 1991   |

Valentine teaches a plurality of poppet valves positioned by their stems, which are not all parallel. A rocker is mounted such that a rocking axis is produced transverse to each stem axis and the tappet elements are not on the same plane through the rocker axis. Each valve has an intermediate lift travel and the rocker axis is in line with the point of engagement with the tappet having the end face of the valve stem perpendicular to the valve stem axis.

Ishikawa discloses an auxiliary valve preventing any communication to the cylinder until the auxiliary valve has been lifted beyond a predetermined point.

Irimajiri et al utilize a valve operating system having main and auxiliary rocker arms for operating valves, each having a common upper tappet, push rod and lower cam operated tappet connected by a ball and socket joint. A similar cam operated assembly is provided for the exhaust valve, which also employs a rocker arm for actuation.

Heintz teaches an internal combustion engine with the spark plug positioned between the intake and exhaust valve.

Hofer uses one rocker arm pivoted on either side of the cylinder head with a pivoted lever linkage arranged across the cylinder head opposite the camshaft with two inlet and two outlet valves disclosed.

Arao discloses a four valve head with rocker arms having fingers attached for operation of each valve, however this arrangement requires periodic adjustment of the valve operating clearances. It cannot effectively use a single hydraulic tappet for each pair of valves.

For background purposes and as indicative of the art to which the invention relates, reference may be made to the remaining cited patent.

## DISCLOSURE OF THE INVENTION

Existing Harley Davidson motorcycle engines with push-rod operated valves and after-market copies of these engines employ two valves per cylinder which has been dictated by economy. While this approach is basically acceptable, there are some inefficiencies, such as restricted flow areas through valve ports which limit power at high engine speeds. Further, the position of the spark plug is not in the optimum location which should be in the center of the combustion chamber and the shape of the combustion chamber is governed by the two valve design not resulting in the lowest possible exhaust emissions and highest combustion efficiency.

It is, therefore a primary object of the invention to employ a unique conversion head utilizing four valves with the spark plug in the center with the standard single arm rocker arm imparting equal displacements of a pair of valves through a yoke. This combination creates a near optimum configuration of the combustion chamber and allows the exhaust and intake valves to have an angular displacement between 50 to 70 degrees with no change required in the remainder of the engine.

An important object of the invention is the novel approach to the valve arrangement replacing the heretofore two- valve system of valves with angular displacement between them, with a more efficient four-valve system having the valves arranged in the classical "V" position when viewed from the end of the crankshaft creating a "pentroof" type combustion chamber.

The design of the present invention accomplishes the desired use of greater flow yielding four valves at angles allowing the spark plug location and combustion chamber to be advantageous and highly superior to the prior art.

Another object of the invention leads to higher engine speeds and greater power while using the standard intake and exhaust systems.

Still another object of the invention increases performance with less emissions as the combustion chamber's configuration is conducive for charge combustion and therefore the fuel is efficiently consumed. Further, this advantageous head system provides reliability and ease of maintenance due to the effective use of the automatically adjusting hydraulic tappets.

These and other objects and advantages of the present invention will become apparent from the subsequent detailed description of the preferred embodiment and the appended claims taken in conjunction with the accompanying drawings.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

**FIG. 1** is a cross-sectional view of the head taken along a typical valve arrangement illustrating the valves, spark plug, rocker arm, rocker arm shafts and push rods. It will be noted that this view is representative of all of the components as they are identical to each cylinder.

**FIG.2** is a cross sectional view taken along lines **2-2** just below the inside of the valve cover illustrating in plan view the valve rocker arm and yoke arrangement.

**FIG. 3** is view of the combustion chamber side depicting the valve and spark plug as they enter the combustion chamber and also the arrangement of the pushrods entering the head from the engine block.

#### **BEST MODE FOR CARRYING OUT THE INVENTION**

The best mode for carrying out the invention is presented in terms of a preferred embodiment and is illustrated in FIGS. 1 thru 3. The invention is limited to a head assembly **20** for a gasoline engine having an internal cam shaft and push rod system, specifically the Harley Davidson engine and copies thereof. The head **20** has a

pair of exhaust valve ports **22** with seats **24** and a pair of intake valve ports **26** also with seats **28**. The seats are alternatively formed with bushings, as depicted in FIG. 1.

The head **20** further contains a plurality of push rod passages **30** in linear alignment with the hydraulic valve lifters (not shown) one passage **30** for each pair of valves. Further, a threaded hole **32** for the spark plug is centrally located between the valves in the general area the ports **22** and **26** with the hole **32** recessed and the area thereunder forming a combustion chamber **34**.

A pair of exhaust valves **36** are transversely parallel but are disposed at **25** to **35** degrees from the cylinder centerline and are contiguous with the exhaust valve port **22** and seat **24**. FIG. 1 and 3 illustrate this positioning relationship which is important to the invention in that it allows all of the valves to be in close proximity and optimally position the spark plug in the center there between.

A pair of equal length inlet valves **38** are parallel to each other and are disposed angularly with respect to each cylinder in the engine and are contiguous with the intake port **26** and seat **28** again. FIGS. 1 and 2 depict this configuration. The angularity is obviously kept a minimum, however, it has been found that an angle "a" as shown in FIG 1, of **25** to **35** degrees is acceptable, with **30** degrees preferred.

A plurality of standard Harley Davidson rocker arms **40** with valve springs **42** are each attached to the stem **44** of the exhaust and inlet valves **36** and **38** for returning the valve to the seat **24** and **28** in the head **20**. The springs **42** assist in returning the valves to the closed position and the pressure of combustion forces the valve into a tight relationship with the seat sealing the ports **22** and **26**. Air cooling fins are shown as **56** and the valve cover as **58**.

A pair of rocker arm shafts **46** retain the rocker arms **40**, one for each set of related exhaust valves **36**, and the other for the inlet valves **38**.

A number of push rods 50 are positioned in the passages 30, as shown pictorially in FIG. 1 and are in alignment with a rocker arm 40 and it in turn with a yoke 54 such that each pair of valve are lifted simultaneously from the head 20 in sequence producing a timed cyclic allowing function of the reciprocating engine.

It will be noted that the positioning of the valves 36 and 38 along with the spark plug 52 in the hole 32 is critical to the invention and is part of the novelty, along with the ability to utilize the remainder of the engine without modification.

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